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ABSTRACT

This unit, developed by the Third World Science Project, is designed to add a multicultural element to existing science syllabi (for students aged 11-16) in the United Kingdom. The project seeks to develop an appreciation of the: boundless fascination of the natural world; knowledge, skills, and expertise possessed by men/women everywhere; application of knowledge and skills to solve the practical problems of everyday life; impact of modern technology in the world; and the influence of the cultural background on the perception of knowledge, problems, and solutions. The introduction to this unit traces the historical background of plant use as the only source of drugs for man, considering the belief that a cure for every disease can be found among members of the plant kingdom. Topics areas considered in following sections include: increasing respectability of "primitive" herbal healing; drugs and poisons; major drugs obtained from plants; plants that bring health and death, considering plant chemicals that destroy tumors, reduce blood pressure, paralyze muscles, or prevent conception; African medicine (suggesting students similarly list and identify local plants having medicinal value); and herbs and modern drugs. The unit concludes with a list of plants and their popular drug derivatives. (JN)

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PLANTS AND MEDICINES.

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THIRD WORLD SCIENCE

Third World Science seeks to develop an appreciation of:

1 The boundless fascination of the natural world

2 The knowledge, skills and expertise possessed by men and women everywhere

3 The application of knowledge, skills and expertise to solve the practical problems of everyday life

4 The impact of modern technology in the third world

5 The influence of the cultural background on the perception of knowledge, problems and solutions

The following Units have been designed to fit into existing science syllabuses in the United Kingdom:

CARRYING LOADS ON HEADS: CHARCOAL: CLAY POTS:
DENTAL CARE: DISTILLATION: ENERGY CONVERTORS:
FERMENTATION: HOUSING: IRON SMELTING: METHANE DIGESTORS:
NATURAL DYES: PLANTS AND MEDICINES: SALT: SOAP.

The method of use is not closely prescribed. As resources teachers may use them in different ways though suggestions are offered. Feedback is invited from teachers concerning (a) the use made of the material (b) pupils reactions, if possible in their own words, and (c) suggestions for improvements, additions etc.

Please send feedback, ideas and requests to:

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PLANTS AND MEDICINES

Teacher's Notes

For thousands of years man used what was very much at hand - plants - to form the basis of natural cosmetics, remedies and preventatives. Generation after generation, the secrets of the plants were handed down until, in modern times, they lost credence with advocates of 'modern' medicine. Now, at last we are re-discovering the value of the vital properties of these plants.

The introduction to this unit traces the historical background of the use of plants as the only source of drugs for man - with a wide acceptance of the belief that a cure for every disease could be found amongst the plant kingdom.

This is followed by an extract from an article by Joseph Hanlon, reporting from Africa on the increasing respectability of 'primitive' herbal healing. Plant medicine is still the norm in most of the world, and is not being swept aside by synthetic drugs.

The next section deals with drugs and poisons, and the major drugs obtained from plants - only a selection of the better known drugs have been described. Possibly, the information on Quinine could be used in conjuncton with a biology lesson on the Anopheles mosquito. Some of this information has been obtained from an article by Dr. D. Bailey on 'Plants and Medicinal Chemistry'. Dr. Bailey is a lecturer in medicinal chemistry at the Welsh School of Pharmacy, UWIST, Cardiff.

Extracts from an article by John Humphreys deal with 'Plants that bring health - or death'. Increasing evidence shows that plants yield chemicals that destroy tumours, reduce blood pressure, paralyse the muscles or prevent conception; or indeed, in the wrong doses, kill people.

The section on African Medicine was contributed by third year pupils of Lubushi Seminary, Zambia. Perhaps a similar class activity could be followed, listing and identifying local plants that have medical value.

The unit concludes with a brief consideration of the role of the Herbalist in the discovery of drugs, with the rise in importance of chemotherapy putting into temporary eclipse medical interest in drugs of plant origin. However, with the recent rediscovery of the effectiveness of the active principle of various old-fashioned herbs - a new era of plant hunting has begun.

PLANTS AND MEDICINES

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Introduction to Plants and Medicines

Until the mid 9th century, and the birth of synthetic organic chemistry, plants were the only source of drugs for man. Although synthetics have replaced many plant drugs, some still retain their old importance, often due to their complexity. Nearly half of the prescriptions written annually in the U.S. contain a drug of natural origin, either as the sole ingredient or as one of the two main ingredients. Plants still provide the major source of such valuable substances as morphine, digitalis and senna. During the past decade the Mexican yam has become immensely important because it provides a convenient starting material for synthesising many of the steroidal drugs.

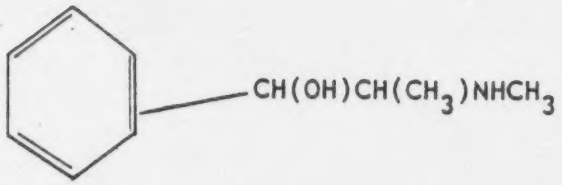
Not only are plants important as medicines in their own right but they also provide useful starting materials from which other drugs can often be relatively easily prepared. In addition, the structure of many synthetic drugs resulted directly from an observation of some biologically active plant material. For instance, the introduction of aspirin and the salicylates into medicine followed the realisation that the traditional pain relieving property of willow bark was due to the presence of salicyl glucoside.

Over the centuries plants have made important contributions to medicine. One can readily imagine that primitive man soon started to experiment with the plants that grew all round him in an attempt to treat injuries and cure sickness. During the centuries that followed he made his trials and his errors until gradually, one by one, a number of worthwhile remedies were discovered.

Throughout the ages and right up until the beginning of the present century medicine depended largely on the use of plants. Substances like *opium*, *senna* and *digitalis* still have a very important place in present day medicine. It is, remarkable that so many useful drugs emerged from what was, frequently, a very haphazard approach to trial and error.

One of the earliest medicines recorded consisted of an infusion of dried shoots of a plant known to ancient Chinese as *Ma Huang*. This was described in 2760 BC by the physician emperor *Shen Nung* as being a valuable remedy for coughs and as a cardiac stimulant. The active principle of this plant was eventually introduced into Western medicine in 1924 and named *ephedrine*. Chemically, and to a certain extent biologically, *ephedrine* resembles the neural hormone *adrenaline*. Unfortunately, the use of adrenaline in medicine is limited by its lack of stability. Unless it is very carefully stored it is rapidly oxidised to adenochrome. Secondly, adrenaline cannot be given by

EPHEDRINE



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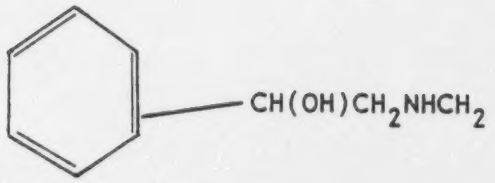
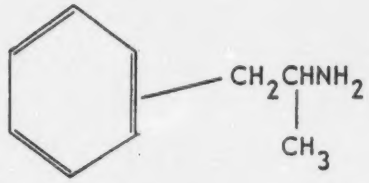


mouth since it is immediately inactivated by the digestive juices. Even when given by injection it has only a comparatively short lasting action due to its breakdown by the *amine* and the *catachol* oxidase enzymes present in the body. *Ephedrine* which lacks the two phenolic hydroxyl groups, is far more stable during both storage and administration. *Ephedrine* is still widely used in tablet and liquid form for relieving asthma and nasal congestion.

In 1933, during an attempt to find a synthetic analogue of *ephedrine*, the compound *amphetamine* was shown to resemble *ephedrine* in a number of its

AMPHETAMINE



pharmacological properties. *Amphetamine* was first widely used as a nasal decongestant but later it was used, and abused, as a stimulant.

During the Middle Ages the widely accepted dogma that a cure for every disease could be found in nature provided an incentive in the search for medicines amongst the plant kingdom. It was commonly supposed that the signature of a disease was in some way impressed upon that plant which could be used to treat that particular disease e.g. plants with red flowers were used to prevent bleeding.

WHEN THE SCIENTIST MEETS THE MEDICINE MEN

(An extract from Nature Vol. 279 by Joseph Hanlon)

Plant medicine is still the norm in most of the world and is not being swept aside by synthetic drugs. One reason is that medicinal plants work.

This point has not been lost on multinational pharmaceutical companies. Faced with spiralling research costs, they are paying more attention to traditional medicines and Third World research - which leads to the sharpest contradiction for Ghanaian scientists. They are dependant on high technology only available in European and U.S. labs, and collaboration with those labs, is crucial. Yet that means the drug companies are likely to get their hands on the results first. Some scientists fear that new drugs discovered in Ghana and other developing countries will be patented by the multinationals and then sold back to developing countries at high prices. The Organisation of African Unity (OAU) has gone so far as to urge secrecy in herbal medicine research to prevent just this.

Publicity about Chinese traditional medicine system - both acupuncture and herbal - gave traditional healing international respectability, and plant medicine is now being promoted by the World Health Organisation.

The Faculty of Pharmacy at the University of Science and Technology in Kumasi has for several years worked primarily on plant medicines. Ghana's Centre for Scientific Research into Plant Medicine is one of four centres with offical OAU backing.

The first research step is always to identify as many active compounds as possible. If one is found with a structure akin to a known pharmacologically active substance, then it explains how the medicine works, and also serves as proof to doubting Western trained doctors who continue to resist plant medicine. Pharmaceutical chemists are happiest working with compounds close to those they know and understand.

Testing for safety and side effects

Plants vary widely according to soil and the time of year and sometimes even the time of day when they are picked. Some plants can be highly toxic at certain times of the year and not at others. The herbalists know their local plants well, but this does not help those without specialist knowledge. Storage also remains a problem, and the method of preparation is often not precise: "*Put a little into water*" - but how much?

Traditional medicines, too, have their side effects and some safety testing seems called for. Most tropical plants contain poisonous alkaloids.

In some cases, if one plant is used for treatment, then another must be taken as well to eliminate the toxic effect.

Traditional healers have been ridiculed in the West - and by Western-trained Ghanaians - because of the continued failure to find "scientific" justification for their claims. The Ghanaians argue that western scientists are so confident of their own methods that they are unwilling to listen to anyone from a developing country, despite the hundreds of years of careful study of plant medicine by the herbalists.

DRUGS AND POISONS

Some plants contain organic substances that have powerful effects on the body functions of man and other animals. There are some that affect the rate of heart beat, respiration, muscular action, whilst others are analgesic. Consequently, such substances have become important in the field of medicine in the treatment of disease and as aids to surgery. Although such plants may save life in small dosages, they prove to be fatal poisons in larger amounts.

Some of the pain-killing substances are narcotics, powerful enough to induce a state of coma. The alkaloid *nicotine* in tobacco is a narcotic and is *addictive*. A person addicted to morphine suffers extreme mental and physical anguish if denied supplies of the drug. Because of their potential danger, the cultivation and use of narcotic-containing plants are now controlled by law in every country. Despite this, drug addiction is a serious social problem in countries all over the world.

Awareness of the existence of plants containing narcotics and poisons is almost as old as society itself. The lives of the primitive food-gathers depended as much on this knowledge as on the ability to find food. Certain jungle tribesmen know exactly which climbing plants will yield the poisons with which they tip their arrows - though many European botanical experts have great difficulty in distinguishing these plants and harmless ones.

Many peculiar ideas were held by herbalists and apothecaries until modern chemical and pharmaceutical science identified and showed the exact effects of the active principles of drug-producing plants. At one time it was believed that if a plant resembled part of the human anatomy it could cure disease of that part e.g. a lichen that grows on the oak tree, and resembles a human lung, was once called *Lungs of Oak* and was often prescribed for chest ailments. Healing powers were believed to be present in any plants with a strong, unpleasant taste or smell. Many people were too ready to believe that they could be cured at least partially by a "medicine" which was chemically harmless, but whose vile taste convinced them of its efficacy.

Some plants are less important than they once were because chemists have discovered ways to synthesize their active principles by other means and from other materials. Synthetic drugs are more desirable than those derived from plants; they are cheaper to produce in bulk and their quality is easier

to standardize. A drug obtained solely from a natural source needs considerable space and also cheap labour in order to cultivate and harvest sufficient quantities of the plant. Most plants shows a marked seasonal and climate variation in their biological activity. This means that each individual batch must be separately assayed. On the other hand, any two samples of a synthetic product should always have exactly the same activity.

Another very real problem is the adulteration of the correct plant with biologically inert or even harmful substances - once again this means tedious tests for identification.

War or political unrest may disrupt the supply of a naturally occurring drug as happened with *quinine* during the Second World War.

For these reasons, once a plant has been shown to have useful biological property an attempt is made by chemists to isolate, and identify the active principle. This can then be prepared in the laboratory to give a constant supply of the pure material. Sometimes this proves too complicated or too costly to be economic. In such cases the plant remains the sole source of the drug.

Research into medicinal plants is now a high priority in Ghana, and it typifies the issues in science there because it is essentially local and yet, at the same time, tied to the developed world..

Herbal medicine researchers use sophisticated analytical Chemistry techniques, collaborated with laboratories all over the world and publish in prestige western journals. Yet they rely on the knowledge of traditional healers to solve problems of tropical medicine which have been ignored by a medical science dominated by the developing countries. Herbal medicine conjures up images of witch doctors and 'primitive' cures. In fact, western drugs came almost entirely from plant and fungus extracts until the 1930's. And many drugs, particularly contraceptive pills, still do.

MAJOR DRUGS OBTAINED FROM PLANTS

There are tens of thousands of untested plants even in well-explored countries, and there are certain to be plants that are now making chemicals that will cure all our worst cancers and plagues. A selection of the better known drugs are dealt with in this section.

Quinine from the Cinchona Tree

Malaria has afflicted people living in humid, and especially marshy, places since prehistoric times. It is a recurrent fever that causes the sufferer to shake, render him incapable of active work until each attack passes, and sometimes fatal. It is caused by a minute form of animal life called a *protozoan*, which can be carried from one human to another only by blood-sucking mosquitoes of the genus, *Anopheles*. Hence it can be checked to a large degree by draining the swamps in which the mosquitoes breed, or by putting oil on the surface of streams and ditches, to kill their larvae. But a number of drugs have proved useful in curing the disease. One of these is *quinine*,

Stripping Cinchona bark.

a drug derived from the bark of various species of South American trees of the genus *Cinchona*. When this bitter drug is taken in the right amounts, it enters

the bloodstream and kills the malaria organisms.

The *Cinchona* tree, a small evergreen, grows wild in the high Andes of South America, and also in Panama. The Indians, who had used it from the earliest times, introduced the drug to Catholic missionaries in the 17th century - hence its once-popular nickname, "*Jesuit's bark*". Unfortunately the tree grew only in the remote highlands, and for long they were jealously guarded by the tribes that knew their curative property. During the 19th century, however, a British government expedition succeeded in bringing some young *Cinchona* trees back from Ecuador. By 1860 the *Cinchona* tree was established in India and Java, in both of which countries malaria was a serious problem.

Under cultivation the trees are first raised from seed, then grafted with a special strain that holds a high proportion of *quinine* in its bark. After seven years growth they are cut down and the bark is removed and dried for shipment.

Cinchona bark.

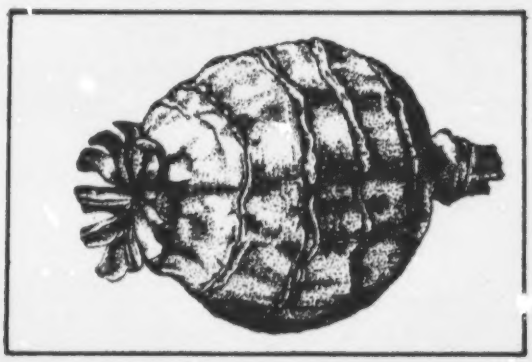
The drug, which consists of four different alkaloids, is extracted from dried bark by dissolving it out with alcohol. Nowadays, synthetic drugs such as *atabrine* are also used to treat malaria, but *quinine* is still employed on a considerable scale. The drug is also used to prevent muscle cramp, and, in small quantities, as a flavouring for "tonic" drinks.

Morphine from Opium Poppies

Since the dawn of history, people have known that a powerful drug could be obtained from the seed vessels of a common poppy plant, *Papaver somniferum*. Its use was recorded by the ancient Egyptians, the Greeks, and the Romans. The opium poppy, which is probably native to Asia Minor, is found in most countries as a weed of cultivation because its tiny seed is hard to separate from that of main-crop plants. It is often grown as an ornamental flower, and its seeds are used in confectionery and as a source of oil. Commercial crops are grown in south-eastern Europe, where cheap labour is available for the tedious work involved.

Poppy capsules.

The poppy which is an annual, is raised from seed and allowed to flower. As the seed pods or capsules form, they are scratched with sharp knives, and white gum (*latex*) slowly exudes from the wounds. This is done at sunset, and the following morning the dried latex is scraped off, again by hand. One acre of opium may carry 20,000 poppy plants, yet it will yield only about 30 pounds of opium.



Capsule scratched to release the latex.

In medicine, opium is used mainly as a source of the drug *morphine*, which is extracted by complex chemical processes. *Morphine* is mainly used to deaden pain arising from accident or disease; it also controls coughing in diseases of the organs of breathing, and induces a feeling of euphoria, or well-being.

Balls of crude opium.

No satisfactory artificial substitute has yet been found for it; moreover it is the only narcotic drug that relieves pain in reasonably safe doses. But much of the opium is grown commercially for selling to drug addicts. Opium-smoking is illegal in most countries. Tincture of morphine, in which the drug is prepared as a liquid, is commonly known as *laudanum;* an artificial derivative of morphine, *heroin,* is also used medically and is perhaps the most dangerous of the addictive drugs.

Other Leading Plant Drugs

The belladonna plant (*Atropa belladonna*) often called deadly nightshade, grows wild in woods and waste places in Europe, and is cultivated in Holland to provide the leaves and roots that yield certain potent drugs. It is a sturdy perennial that sends up a stout stem bearing oval leaves and many purple, bell-shaped flowers, followed by black berries.

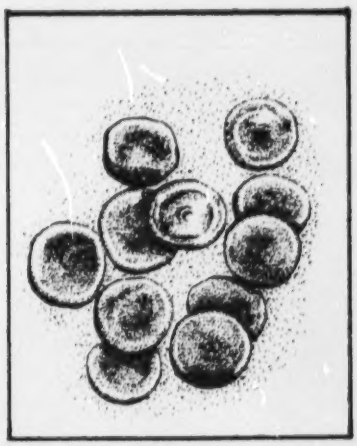
Atropa belladonna

Chemists extract from the dried, powdered leaves, and also from the roots, two drugs called *atropine* and *hyoscine* that relax certain muscles and dry various glands. A recent monograph listed over 50 medicinal uses of *atropine* ranging from the treatment of asthma to the relief of indigestion. It can be used to increase the heart rate and to lower the blood pressure. It is frequently given before an operation to reduce salivation and to prevent sickness.

Pharmacologists at the beginning of this century were at a loss to understand how one drug could exert so many diverse actions. It is now realised that *atropine* prevents the passage of nervous impulses across the neuromuscular junction.

Large doses, especially of *atropine*, cause delirium and subsequently send patients into a coma. *Atropine* also causes the pupil of the eye to dilate, and the plant's name - belladonna means "beautiful lady" - is due to the fact that Italian and Spanish women once used the drug to make their eyes large and alluring.

Strychnine plants (mainly *Strychnos nux-vomica*), which yield two stimulating drugs, the bitter-tasting alkaloids *strychnine*, and *brucine*, grow wild in the jungle of South America, S.E. Asia, and Indonesia. They are small trees, bushes, and climbers of several related species. All bear soft fruits resembling oranges; these are gathered by the drug collectors, who break them open and extract the hard seeds for sale and export. The drugs are obtained from the seed by extraction with alcohol or acid. *Strychnine*, if taken in quantities greater than about 50-100 milligrams, is a deadly poison; it is used in some



Nux-vomica seeds.

countries to kill harmful animals by adding it to an attractive bait. Its main use in medical practice is in awakening people out of narcotic comas; it also increases the acutness of certain kinds of sensory perception.

Cocaine is the only widely used local anaesthetic of plant origin, though there are several synthetic ones. An injection of tincture of *cocaine* has the effect of deadening the responses of nerves in small areas of the body to pain for periods of up to one hour; it is widely used in dentistry. The drug is obtained from the coca tree (*Erythroxylon coca*), which grows wild in the Andes

of South America. The tree is cultivated in South America and in Java, and the commercial drug is obtained from its dried leaves by extraction with alcohol.

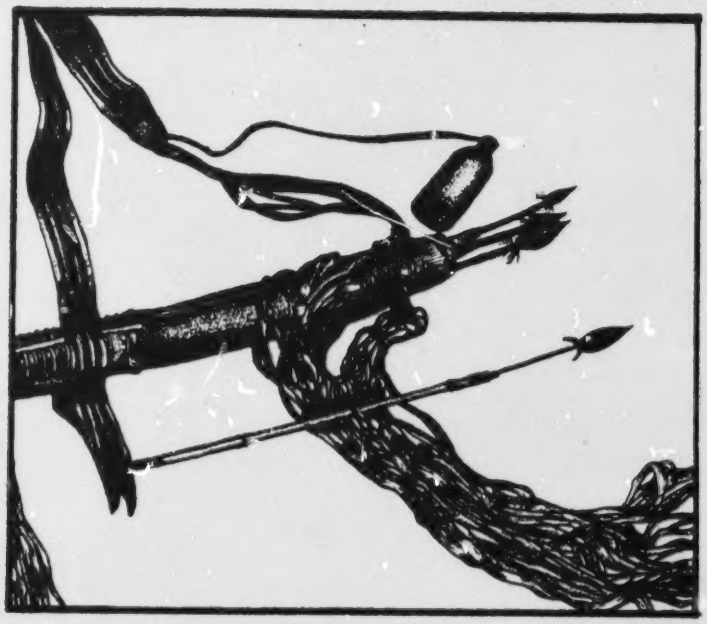
Coca leaves - dried.

Indians in the high Andes chew *coca* leaves: in small concentrations the drug is a stimulant and improves the capacity for work. However, if used constantly in this way *cocaine* becomes addictive. Today *cocaine* has largely been replaced by synthetic compounds such as *procaine*, which has a similar composition and is safer.

Poisons

From earliest times man has always been fascinated by poisons. The first attempts to classify plants were simply to divide them into those which were poisons or harmful and those which were safe to eat. Such observations of the biological action of plants were undoubtedly frequently responsible for the use of many plants in medicine.

Just over a century ago Dr. Livingstone described how the natives of Mozambique could kill large animals which were unharmed by his gun. Their weapon appeared to be a simple arrow but the tip was coated with a substance which the natives extracted from a vine growing high up among the giant trees of the tropical rain forest. The seeds of this vine - called *Strophanthus kombe*, were crushed, mixed with gum and applied to the tips of the arrows. Any animal hit by one of these poisoned arrows could barely run more than 100 metres before collapsing. Livingstone noted that the poison had the effect of slowing the pulse - which explains the present use of *Strophanthus* in cardiac emergencies. The drug is perfectly harmless when taken by mouth - this is the reason why the carcass of an animal killed by one of these arrows can be safely eaten - but if it gets into the blood stream, then it is one of the most poisonous substances known to man.



A quiver of arrows tipped with Strophanthus - from West Africa.

The arrow poison used by the Indians of South America is *curare*, which paralyses the muscles in much the same way as *atropine* and death usually results from suffocation due to the paralysis of the intercostal muscles

When the first crude samples of *curare* were brought to this country, they were regarded as a medical curiosity. A few isolated attempts were made to use it for treating conditions such as lockjaw where the muscles of the jaw will not relax. In 1942 the purified form of *curare*, became available for the first time, its use as a muscle relaxant was at once investigated. By using carefully

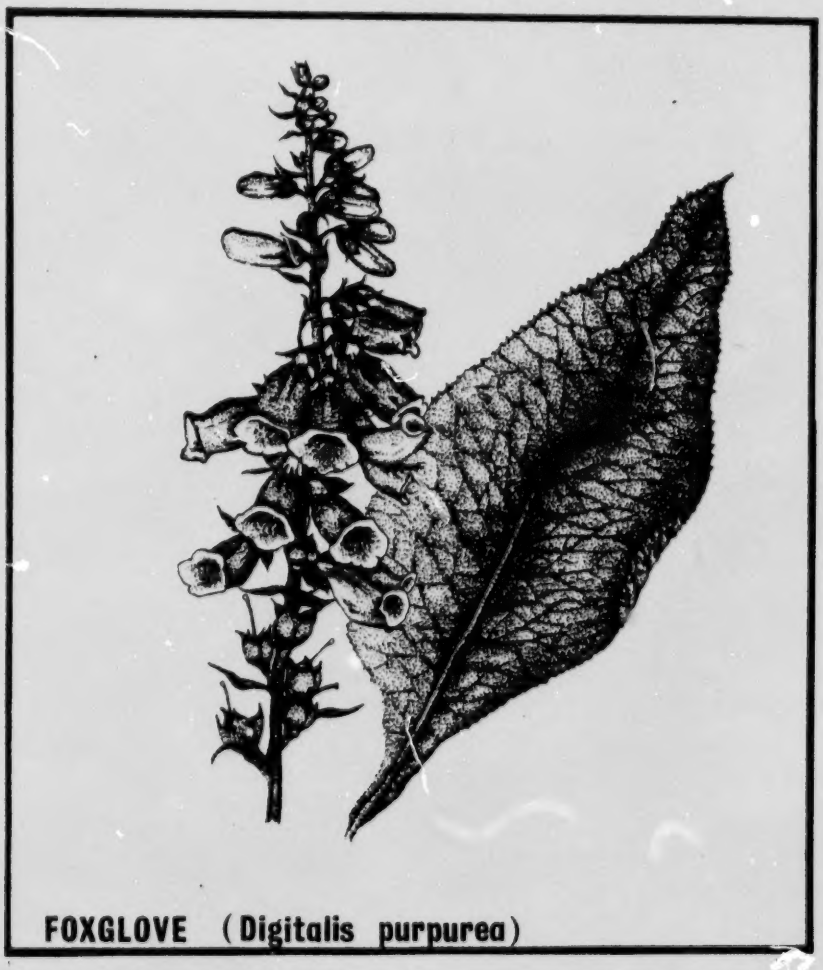
Blow pipe and various darts tipped with curare.

controlled doses, the desired degree of relaxation could be attained without, at the same time, using a dangerously large amount of anaesthetic.

The most active principle in *curare* is *curarine* - which comes from a woody climbing plant belonging to the genus *Chondrodendron*.

DIGITALIS FROM THE FOXGLOVE PLANT

The Foxglove (*Digitalis purpurea*) is a beautiful plant that grows wild in the woods of N.W. Europe. It starts life as a tiny seed that grows, in its first season, into a small tuft of leaves; the following year it develops larger leaves and sends up a tall spike bearing many thimble-shaped, purple flowers. All the material needed for drug-making could easily be gathered from the wild-growing plants, as it used to be in the past. But because chemists need a standardized product, the foxglove is now grown as a field crop in Holland. It is raised as an annual, being sown under glass, transplanted to the fields in June, and given ample fertilizer to make it form



FOXGLOVE (Digitalis purpurea)

big leaves. The leaves are gathered in autumn whilst green and dried slowly under cover in the shade. One form of the drug *digitalis* is made simply

by grinding the leaves into a powder; but usually the leaves are steeped in alcohol, which dissolves out the drug to form *tincture of digitalis*. *Digitalis* contains several glycosides - compounds of which sugars combine with other organic chemicals. These acting together, improve the productive work of the heart while slowing the pulse rate.

In spite of years of effort *digitalis* has never been prepared in the laboratory nor has any synthetic product been found which can completely replace it. Infusions of dried foxglove leaves were used for centuries by simple country folk who knew nothing about its complicated action but were satisfied simply to know that could relieve the *oedema* which often accompanied congestive heart failure.

Even today, tablets made from foxglove leaves are still preferred by some physicians to the purified digitalis glycosides such as *digoxin*. They consider that trace substances present in the natural product are of benefit to their patients.

Over the centuries the empirical use of foxglove has saved many lives but only comparatively recently has the manner in which the drug exerts its action has been determined. The heart muscle is extremely specialised in order to perform its unique action of regular contractious throughout a lifetime. After each contraction there is a short latent period during which the muscle relaxes and the heart refills with blood. In congestive heart failure this latent period is so shortened that the heart never has time to refill with blood completely. *Digitalis* increases the time of this latent period so that, although the heart beats more slowly, each contraction affords an increased cardiac output. These cardiac glycosides are steroid-like derivatives of sugar - and they block an enzyme in the cells of the heart whose job is to maintain a proper balance of sodium and potassium inside and outside the cells. It is the electrical tension maintained by that balance that enables the heart muscle cells to contract rhythmically.

Cardiac glycosides similar to those occuring in *digitalis* are found in *lily of the valley* and extracts of this plant are, in fact, used in some countries instead of *digitalis*.

PLANTS THAT BRING HEALTH - OR DEATH

John Humphreys reports in the New Scientist (25th February 1982) that a child with leukaemia nowadays may be saved by a plant that can be bought in Woolworths, the *Madagascar periwinkle* (*Catharanthus roseus*) formly called *Vinca rosea*. It contains two chemicals that interfere with the assembly of the protein - *tubulin* - which is essential to the structure and form of living cells, and so tips the balance against rapidly dividing cells. Fifteen years ago, children suffering from leukaemia were almost certain to die: now '*leurocristine*' and '*vincaleuko blastine*' have improved their chances of survival. '*Leurocistine*' is an anti-leukaemic drug, and '*vinca leukoblastine*' is active against Hodgkin's lymphoma. Some of the steps that the plant takes to make these chemicals are known, starting from the amimo acid *tryptophan* but no reason is known for the complex web of interconversions that the alkaline undergo. If this plant had not been analysed, not even a chemist's wildest ravings would have hinted that such structures would be pharmacologically active.

Madagascar periwinkle

These substances are "*secondary plant products*", unusual chemicals that do not seem to fit into the plant's conventional biochemical pathways relating to protein, fat and carbohydrate, and once regarded as being useless waste products, made "accidentally" by normal enzymes. However, secondary plant products are now known to be actively made, processed and destroyed by the

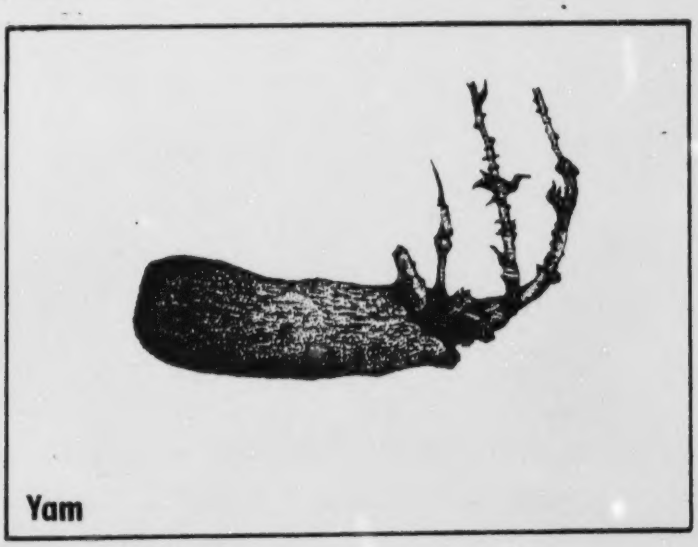
plant, they have always played an important part in man's medicine, and in times past they have controlled whole countries and cultures.

High blood pressure - hypertension - is a widespread and dangerous disorder which in many cases can be controlled by alkaloids from the serpent-wood, *Rauwolfia serpentina*. These chemicals delight under the names *reserpine, rescinnamine etc.* This plant is essential on a cardiologist's drug list, although *reserpine* must be used with caution because it destroys stores of the neurotransmitter *noradrenaline* in the brain and can lead to suicidal depression.

One of the drugs used to treat gout is *colchicine*, a strange compound found in the garden bulb, the autumn crocus. Its action stops white blood cells from exacerbating the pain by invading the site of uric acid deposition. *Colchine* is very poisonous, with the therapeutic dose not too far from the dangerous one. It also has the capacity of causing plants to double the number of chromosomes per cell - i.e. to become *tetraploid* - and hence features in wide range of genetical research.

Birth defects (*teratogenicity*) caused by ingestion of secondary plant products may be commoner than previously thought. The green shoots of potatoes induce *spina bifida* and *anencephaly* (lack of brain) in hamsters. The cause is unknown. Related plants such as the *aubergine* do contain glycosides which are known as *teratogens* - agents that produce birth defects.

However, one group of chemicals, derived from a secondary plant product, has revolutionised the whole of Western society by liberating women from the inevitability of having children. The Mexican yams - *Dioscorea composita* and *D. floribunda* contain the steroid *diosgenin* - the parent compound of contraceptive pills.



Yam

The American mandrake (*Podophyllum peltatum*) manufactures *podophyllotoxin* which is active against various malignant tumors. It is now the centre of extensive study. Some of the analogues being synthesised are more active than the natural compound. The analogues include "*Vepesid*" *VP 16-213*, which is used in the treatment of small-cell lung cancer and resistant forms of testicular cancer.

Other tumour inhibitors of plant origin are in the pipeline which are tipped as important ; many others are known and are now awaiting trials.

AFRICAN MEDICINE - Written by W. Mulengo, S. Fedilis, G. Mulengo.

Introduction

To those who don't know how various trees are called in Bemba, we have prepared a list for some of the trees how they are called in English or in scientific names. We have been helped to find how they are called by a Bemba/ English text book.

Most of the information in this project, is from the elders. There is also some trees at the last pages which are mostly used in preparation of traditional medicines.

We should have written a lot of medicines but they are too complicated at least one medicine explanation can take two or three pages as you know African medicines are too complicated to use.

Discovery and Use

The greatest thing for a human being to be always happy is to be in a good health. But we all know very well that sometimes our health is affected by something that makes our bodies feel bad. The question is why is it so? This is simply because there are times when we feel sick or we are ill. It is also well known to everybody that some various diseases cause our life to end in other words they lead us to death. How do we save ourselves from this danger? That is why there is what we call "Medicine".

We should like also to know that there are various diseases of which some are very serious and require strong medicine and some which can be cured easily. But some diseases can go out without any herbs and some can't like these ones, leprosy, small-pox, malaria and like venereal diseases for instance "syphilis" and others. These kinds of diseases need strong medicines to cope with as to finish them.

Explanation of Discovery of Medicine.

But how had all these medicines been discovered by man? The answer is not all that simple to give or explain as people say it in many ways. The explanation we are going to encounter may be the correct one. Let us first for a short while think about ancient people had started to cure themselves and how they discovered their remedy. Through oral tradition we have heard from elders that medicine resulted from many ways some were successful and some not.

Some medicines according to what is said were discovered by visions (dreams) during night. That is why it is still happens so that you can dream someone

showing you something strange especially medicine. Some herbs were discovered by contact. By this I mean let say you have a pain in your eye, you happen to pass under a tree or near by which has got some kind of liquid and all of a sudden some liquid fall into your eyes. That day or at that particular time you feel better. So people saw was another way in which they discovered their medicines. But bear in mind that a lot of these kind of medicines discovered in these ways were not many and popular. Why? In case they killed many people some were left blind, just the majority.

It has also been said that during the famine a lot of people were dying. Why was it so? It is simply because whenever they tried to dig up some root-food, some roots were too dangerous and others were not, as they are still now. People were dying like animals and it was from this process that man discovered some root-trees and plant-leaves which were poisonous. In this way not only medicine had been discovered but also the way in which certain types of root-food were discovered.

Wrong Application of Medicine

But in accordance with the use of their medicines we can see and we have been told that there were no good ways or methods of giving someone the medicine according to the medicine needed. It is because the amount of medicine sometimes were a little bit good supplied and sometimes not. This means they could take the herbs to give somebody without knowing how much they should give him. That is why deaths were much more because of wrong giving of medicine. As a matter of fact it showed them as if medicine had little use to them. This is still happening to our people in villages.

Why should African Medicine not Develop?

A lot of people say our medicines will soon disappear, why? It is because the people having these medicines don't give or show them to others unless they are paid. So whoever having these medicines has to buy for himself of herself. So when these people who know medicines die, it will also be the die away of their medicines as long as nobody knows them. This is quite true. As the saying goes in Bemba "Ingranda Ishikuka Llo fwo" which means we young people have to know things we don't know from our parents while while they are still alive, so as to be the future users. If you leave your parents' home for another place where no relatives are available and unfortunately you become ill what can you do? Had you known such things before you wouldn't have been in so much a danger. So let us have these in advance, so as to overcome any problems facing us in future. But witch doctors need to be paid as they also paid for them in some ways or others.

But bear in mind that it is very dangerous to give somebody medicine without any proof of it or without knowing how it is applied. In this case lots of people bring misery. Let us not be blind about this.

How some Medicines are Applied

Those who don't know how certain types of trees are called, in Bemba is a list at the back as you are already told at the beginning.

Vomiting (Umuluko)

Find where a small mutungulu is, dig some of its roots and soak them in a cup or bowl of water then swallow the sap when it has become a little bit bitter.

Mutungulu.

This plant bears a kind of brown fruits when they are unripe, and when ripe red. It can be found in most of the places in Zambia especially in chipya areas. Its fruits are half in the ground and half outside near the stem.

Diarrhoea

Take some bark of Mupundu tree, soak them in a cup or bowl of water until the water becomes a little bit red then drink the sap. This is mostly used to young child to elders.

Mufunau.

This tree is very important and useful of its fruits. Its fruits are used for making a kind of juice which is mostly used to make porridge. Its fruits are green when unripe, when ripe yellow.

Diarrhoea

Take some of mulombwas bark soak them in a cup of water then drink the sap when it is red. This medicine when dissolved in water it is very bitter.

Mulombwa.

This tree is very important for all kinds of carpentry. It is a little bit hard and brownish in colour when planed it looks very nice.

Stomach trouble

Take some of muchisha leaves with your mouth while your eyes are closed. Chew them and swallow the sap, the sap is a little bit bitter. When chewed the leaves are completey green with a black trunk. Sometimes it bears fruits which are very small.

Mushisha.

Headache

Take some of Chibangalumes roots dry them, then grind them and make tattoo marks around your head. This plant can be found anywhere but it is very difficult to draw it.

Vomiting

Dig some mumfwemfwe roots, soak them in a cup of water and then drink the sap. This plant is very small and most of the time it is found with white flowers. The flowers are always at the ends.

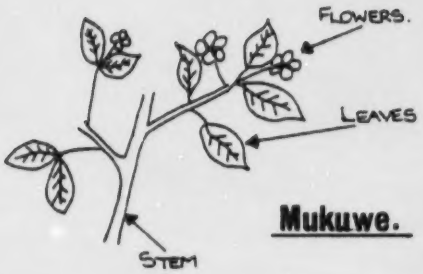
Toothache

Take some mufungo leaves chew them and then swallow the sap. This tree bears green fruits when unripe and black when ripe. It can be found nearly in all places in Zambia.

See on the next pages where some of the trees which are very important are drawn and written.

This is just to help others understand the project well.

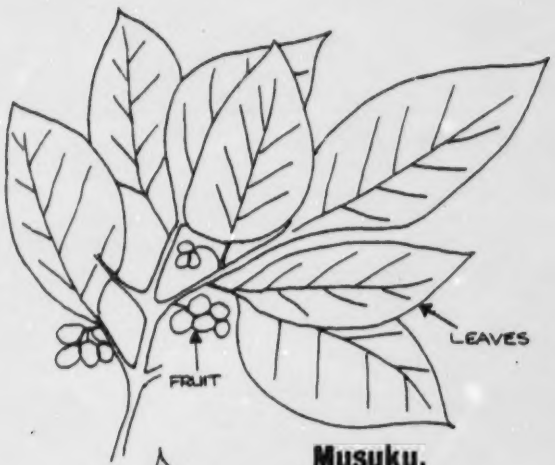
Bemba		Scientific Names
Kaimbi	.....	Erythrophleum
Mululu	.....	
Mofu	.....	Entadrophragma delevayi Guerte
Mulombwa	.....	Pterocarpus angclensis D. Loud
Mupapa	.....	Atzelia quanzensis Welio
Mupundu	.....	Parinarium Mobola Oliv
Janingo	.....	Faurea specioso Welio
Mubango	.....	Atromosia angolensis
Cipamba	.....	Monotes oblongitolius Hutch
Lwumba	.....	Syzygium
Mucenja	.....	Diospyros
Mukuwe	.....	Hirtello bangweolensis
Museshi	.....	Manguesia macroura Gilg
Mwengele	.....	Xylopiya
Musase	.....	Albizzia sericocephola Benth
Mulobo	.....	Berlinia craibiano Bat. F.
Mulunguti	.....	Erythrina abyssinica Lam
Ndale	.....	Swortzia Madagascarensis
Kalongwe	.....	Dalbergia nitidulo Welio
Mutondo	.....	Brachystegio altenii Burt Davy
Mpuso	.....	
Ciya	.....	
Muombo	.....	Brachystegio longifelia
Ngalau	.....	" taxfolio haims
Mushike	.....	" microphylla haims
Mushike	.....	" speciformis Bentls



Mukuwe.

Mukuwe

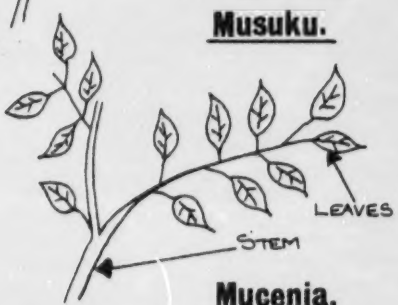
It is very much used for house poles or rafters and for charcoal.



Musuku.

Musuku

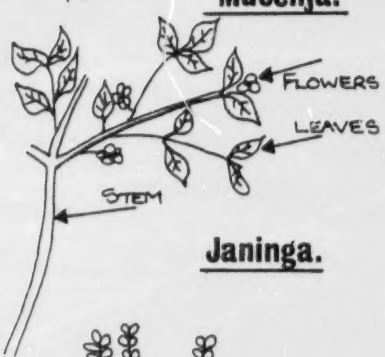
Very small tree and every year bears fruits which are very much eaten by Africans. Its leaves are very large. This tree is found in Chikokola woodland areas.



Mucenja.

Mucenja

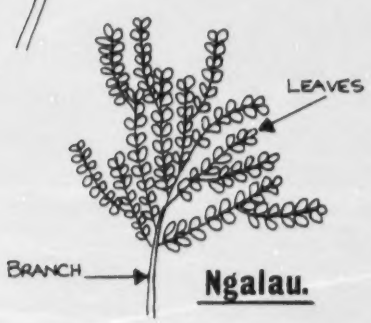
Is very small and always on top of anthills. It is very much used for cleaning the teeth.



Janinga.

Janinga

This tree can be found in most of the places in Zambia. It is very much used for roofing.



Ngalau.

Ngalau

It can be found in most of the places in Zambia. It is very much used for fibre. Its fibre is used for many works especially for house building in villages.

Musompa.

STEM WITH LEAVES, FLOWERS AND FRUIT.

Musompa

Is a small tree found in Northern areas of Zambia. It is used for mining timber charcoal and firewood. Stem with leaves, flowers and pods.

Mululu.

FLOWERS, SEEDS AND LEAVES.

Mululu

Evergreen tree found along river banks in the Northern and Central parts of Zambia. The bark and roots are used in traditional medicines.

FLOWERS, LEAVES AND SEEDPOD.

Kaimb.

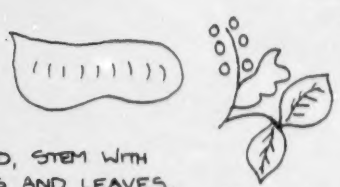
Kaimb

Found in the Chipya woodland on lake basin soil. The bark and roots are used for traditional medicines.

Mukwa.

Mukwa

Flowers and leaves. Found in the Chipya woodland areas. It is the chief furniture wood in Zambia. The sap from the bark is used as fish poison and the roots, sap and bark are used in preparation of traditional medicines.

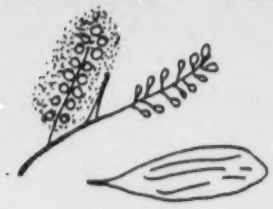


SEEDPOD, STEM WITH FLOWERS AND LEAVES.

Mupapa.

Mupapa

The bark and roots are used in preparation of traditional medicines.



SEEDPOD, FLOWERS AND LEAVES.

Muwaka

Muwaka

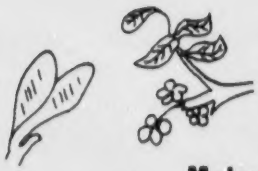
The pods are ground up into a paste and used as a poison to stun fish.

(ZAMBIAN TEAK.)

Mukusi

Mukusi

Timber reddish-brown, heavy and fine in texture.



Mubamga

Mubamga

The chief carving wood of Zambia, is very hard and heavy. Bark and roots are also used in the preparation of traditional medicines.

HERBS AND MODERN DRUGS

The modern pharmacist stocks a bewildering number of drugs, of which an astonishing proportion have been introduced during recent decades. One immensely important category, that of the antibiotics, derives from fungi, a group of saprophytic plants. Though some of the modern pharmacist's other drugs are also derived from plants well known to the ancient physicians, only old fashioned drug stores stock more than a negligible number of what the Herbalist call "*simples*" - i.e. plant leaves or seeds, or roots, or bark which might be administered alone, though they might also serve as ingredients in prescriptions.

The number of such *simples* described by the more advanced Herbalist must be even greater that the drugs commonly found today on a given pharmacist's shelves. Some of them were described as *specifics* (i.e. certain cures) for various distresses, including that of the bite of the mad dog. Pliny devotes one section of his *Natural History* to listing the names of various plants with all the diseases they are supposed to cure. *Garlic*, for instance, is good for 61 different disorders. *Lettuce* for 42; *Hawkweed* for 17; *Cabbage* for 87; and *Pennyroyal* for 25. Moreover, there is in all the Herbals a very great deal of overlapping - the same disease can be treated by any one of a dozen or more *simples*.

Now, it is a general rule that when many remedies are prescribed to correct any evil - physical, mental, economic, or political - it is highly probable that none of them are very effective. The number of cures available for the common cold is sufficient to demonstrate that this role is valid today, and where it not for stern government control it is certain that we would find advertised in the magazines and on television many sure cures for everything from cancer to this same common cold - instead of those many claims that this or that "*helps to relieve the symptoms of*", which now rules the airwaves. Today, scarcely less than in ancient times, men are eager to believe in whatever promises deliverance from any bodily ill, whether the saviour be a new wonder drug or any one of the fads which sweep the country from time to time.

The fact remains, nevertheless, that the Herbalist did employ a considerable number of plants whose physiological effects were genuine, and still recognized, and, in some cases, are still commonly prescribed. Where no effective remedy was known, it was doubtless just as well that bland, innocuous herbs were administered. They served as *placebos* and by inspiring hope in the patient helped to cure him.

Unfortunately, a few of the most effective vegetable drugs - notably *Quinine* and *Cascara* did not reach Europe until the age of the Herbalist was drawing to a close. Even more unfortunately and despite the fact that these Herbalists did recognize the usefulness of a number of plants whose active principles are still employed, there were also cases where they failed to recognize extremely important drugs. The most striking case is that of *Foxglove* or *Digitalis*. Several species of the plant were native to Europe and Asia and it was known to both gardeners and Herbalists. Its specific effect upon the heart was not generally recognized until the late 18th century, when it was discovered by a Dr. William Withering in a manner which demonsrates that folk medicine sometimes has things to teach science and which serves at the same time to illustrate how controlled observation as opposed to loose empiricism was about to transform medicine. Dr. Withering experimented with Foxglove on a large number of patients and, though it proved to be (and it still is) a dangerous drug if not carefully measured and watched, he was ready in 1785 to publish his classic *An Account of the Foxglove and Some of its Medical Uses; With Practical Remarks on Dropsy and Other Diseases.* Thus herb medicine linked with modern research.

Interest in drugs of plant origin tended to fall sharply about the beginning of this century and then to rise sharply again in recent decades.

Around the year 1900 the major contents of the pharmacopoeias consisted of descriptive standards of crude drugs - most of which have since disappeared, although, in a number of cases their *'active principles'* extracted by modern chemical methods are still of major importance - as is notably the case of *Digitalis, Cocaine, Quinine, Caffeine, Codeine etc.*

It was the rise of chemotherapy which put into temporary eclipse medical interest in drugs of plant origin. First *Salvarsan* and then the *Sulpha* drugs seemed to suggest that the laboratory rather than the fields and woods was the place to search for remedies against human ills. The public has hardly yet become aware of the new turn which took place quite recently, when the effectiveness of the active principle of various old-fashioned medical herbs was rediscovered and when new ones were found for the first time. In certain cases botanical medicine and chemotherapy have joined hands. For all these reasons, a new era of plant hunting has begun - and there are certainly more collectors out gathering specimens to be analysed and tested in laboratories than there were even in the great 18th and 19th century era of botanical exploration.

As a Sudanese psychiatrist connected with the World Health Organisation recently advised his colleagues; "*Always stay on good terms with the local witch doctor. I have learned a lot from medicine men*" - a bit of advice which the story of the discovery of *Digitalis* tends to substantiate.

The importance of *Rauwolfia* as well as other recently introduced or re-introduced drugs of vegetable origin suggest that we may be entering an age during which the plant world may again supply the physician with his most useful remedies.

In 1763 the Reverend Edward Stone noticed that willows were likely to flourish in marshy regions where rheumatism was very common. Acting in accord with what was then a pretty old-fashioned theory, he tried a decoction of willow bark on sufferers from rheumatism, and thus discovered the effectivness of *salicylic acid* for the relief of rheumatic pains (*Salix* is Latin for willow). The acid was synthesised some three quarters of a century later. Not long after that, an experimentally-inclined chemist made a derivative whose superiority to salicylic acid was not recognized until later still, when it became famous under the name of *asprin*. Thus we owe what modern doctors regard as one of the most useful of all drugs to what seems to us a preposterously naive theory.

PLANTS AND MEDICINE

PLANT	DRUG	TREATMENT
Willow Bark	Salicyl Glucoside	Pain Killer
Fox Glove	Digitalis	Heart Disorder
Corm	(Alkaloid) Colchicine	Gout
Liquorice	Glycyr-rhetinic Acid	Gastric Ulcers
Poppy (opium)	Morphine	Pain Killer
Poppy (opium)	Codeine	Mild Pain Killer
Erythroxylm Coca (South America)	Cocaine	Anaesthetic
Deadly Night Shade	Atropine	50 Medical uses
Lily of the Valley	Glycosides	Heart Disorder
Strophanthus Kombe (Vine growing in tropical forest)	Strophanthos	Heart Disorder
Curare	D-tubocurarine	Muscle Relaxant
Calabar Bean (Physostigma Venenosum) (Mangrove swamps of West Africa)	Physostigmine	Treats Glaucoma and Myasthenia Gravis
Snake Root (Rauwolfia Sepentina)	Reserpine	Tranquiliser Controls High Blood Pressure
Sisal Plant (Agave Sisalana)	Betamethasone	Skin Disorders
Dioscorea and Bacteria (Mexican Yam)	Cortisone Steroidal compounds	Rheumatoid Athritis Sex Hormones (Oral Contraception)
Khellin (Fruit of Ammi Visnaga)	Disodium Chromoglycate	Asthma (Prevents release of inflàmmatory agents within air passages)
Madagasga Periwinkle	Vincristine	Certain forms of cancer

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